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Nanofluids-its applications and prospects

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Colloidal suspensions of nano-sized particles (less than 100nm) dispersed in a fluid, commonly called nanofluids, have shown potentials as industrial fluids due to their enhanced thermo-physical and chemical characteristics. In spite of numerous reports on the anomalous enhancement in thermos-physical properties of nanofluids, there is still no solid theoretical explanation for such enhancements. Present work details various research works conducted at Texas A&M at Qatar, ranging from fundamental at nano-scale to large-scale applications of nanofluids, to better understand these phenomenon.

Brownian motion of the particles in the fluid and its effect on the flow field is first discussed. Measurements of the physical and optical properties of nanofluids, such as viscosity, surface tension, refractive index, and optical transmittivity are then reported for suspensions with varying particle concentrations. Results of heat transfer experiments for nanofluids in a microchannel and for a scaled-down industrial heat exchanger is then reported. The results show no anomalous heat transfer enhancements, only marginal enhancement in heat transfer that is in agreement with effective medium theory. Further, experiments to study near-wall velocity at nanoscale are then discussed. Results of these experiments help better understanding of the reported viscosity enhancement for these fluids. Possibility of using nanofluids as drilling fluids, at pressures up to 100 MPa, is also discussed. Finally measurement campaign to investigate spray characteristics for suspensions of nanoparticles in Jet A-1 and an alternative Gas-to liquid (GTL) jet fuels are reported.

Biography

Dr. Reza Sadr is associate professor in the mechanical engineering program at Texas A&M University Qatar. His research expertise is in experimental methods in thermo-fluid sciences with focus on advanced energy efficient systems. He received his PhD from University of Utah in 2002. Before joining Texas A&M in 2008, he moved to Georgia Institute of Technology, Atlanta, as research scientist, and then to Georgia Tech Savannah as visiting assistant professor. His current research addresses microfluidics, droplets and sprays, environmental fluid mechanics, and supercritical thermo-fluids. He is a member of American Society of Mechanical Engineering and American Physical Society since 1998.

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